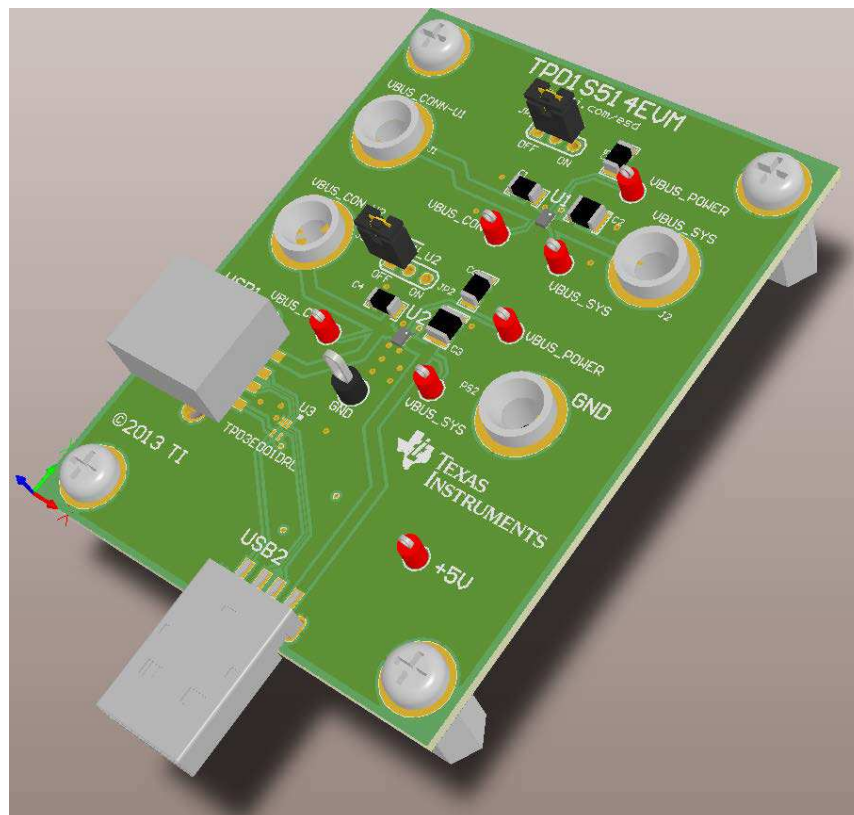


TPD1S514-2EVM

This user's guide describes the characteristics, operation, and use of the TPD1S514-2EVM evaluation module (EVM). This EVM includes 4 TPD1S514-2's in various configurations for testing. One TPD1S514-2 is configured with pin-outs and one TPD1S514-2 is configured with USB 2.0 Type A connectors for throughput analysis. This user's guide includes setup instructions, schematic diagrams, a bill of materials, and printed-circuit board layout drawings for the EVM.



Contents

1	Introduction	2
2	Board Setup	3
	2.1 U1	3
	2.2 U2	4
3	Schematics	5
4	Board Layout	6
5	Bill of Materials	8

List of Figures

1	TPD1S514-2 Board Configuration for U1	3
2	TPD1S514 Board Configuration for U2	4
3	TPD1S514-2EVM Schematic	5
4	Top Layer Copper	6
5	Second Layer Copper	6
6	Layer 3 Copper	6
7	Bottom Layer Copper	6

List of Tables

1	EVM Configuration	2
2	Bill of Materials	8

1 Introduction

Texas Instrument's TPD1S514-2 evaluation module helps designers evaluate the operation and performance of the TPD1S514-2 device. The TPD1S514-2 is a single-chip solution for USB connector's VBUS line protection. The bi-directional nFET switch ensures safe current flow in both charging and host mode while protecting the internal system circuits from any over-voltage conditions at the V_{BUS_CON} pin. On the V_{BUS_CON} pin, this device can handle over-voltage protection up to 30 V. After the \overline{EN} pin toggles low, the TPD1S514-2 waits 21 ms before turning ON the nFET through a startup delay. V_{BUS_POWER} pin indicates the nFET is completely turned ON.

Table 1. EVM Configuration

Reference Designator	TI Part Number	Configuration
U1	TPD1S514-2	Surge
U2 and U3	TPD1S514-2 and TPD3E001	Surge and ESD

2 Board Setup

This section describes the intended use of the TPD1S514-2EVM. A generalized outline of the procedure given in IEC-61000-4-5 is described here. IEC-61000-4-5 should be referred to for a more specific testing outline. Connect +5V and GND during any tests.

2.1 U1

TPD1S514-2 (U1) is pinned out to allow evaluating device performance during normal operating conditions as well as during surge events. V_{BUS_CON} is J1 and V_{BUS_SYS} is J2. A 3-pin header (JP2) allows shunting the \overline{EN} pin on or off. Test points allow monitoring of V_{BUS_CON} , V_{BUS_SYS} , and V_{BUS_POWER} . TPD1S514-2 can pass up to 3.5 A continuous current from V_{BUS_CON} to V_{BUS_SYS} . R_{DYN} can be measured under these conditions using the test points V_{BUS_CON} and V_{BUS_SYS} , where $R_{DYN} = (V_{V_{BUS_CON}} - V_{V_{BUS_SYS}}) / I_{V_{BUS}}$.

Surge can be injected onto V_{BUS_CON} using J1. Over Voltage Protection (OVP) and Under Voltage Lockout (UVLO) can be measured by sweeping 0 V - 30 V on V_{BUS_CONN} and measuring at the three test points. V_{BUS_SYS} should have a load typical to the expected operational condition.

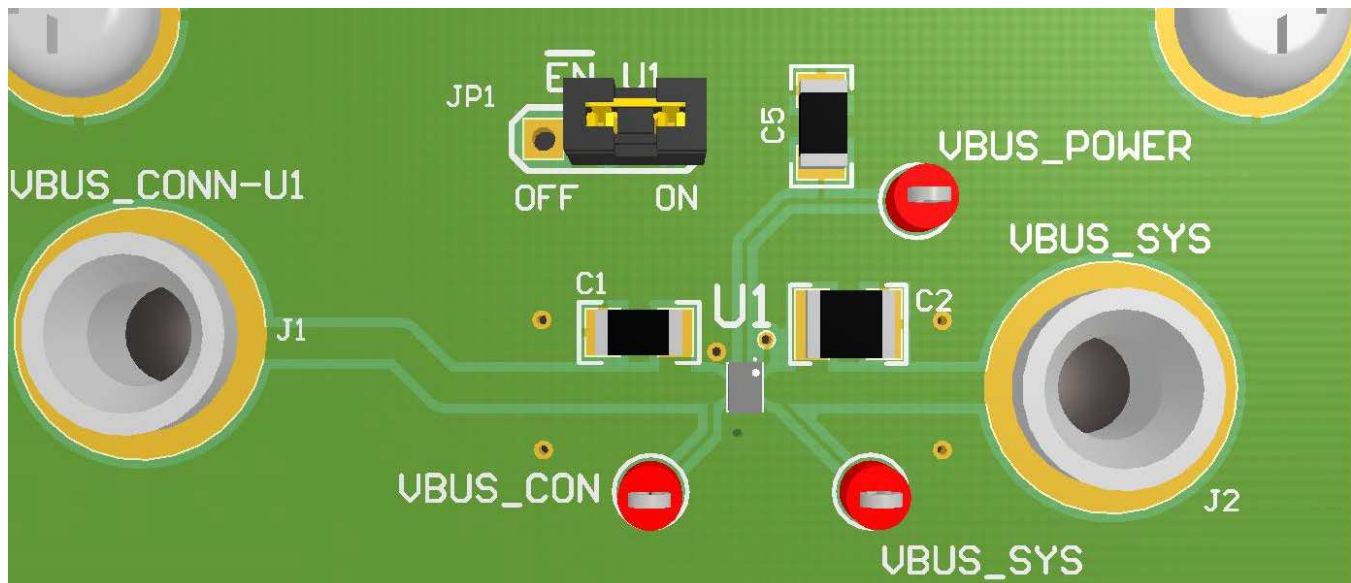


Figure 1. TPD1S514-2 Board Configuration for U1

Timing measurements should be performed after removal of C1, C2, and C3.

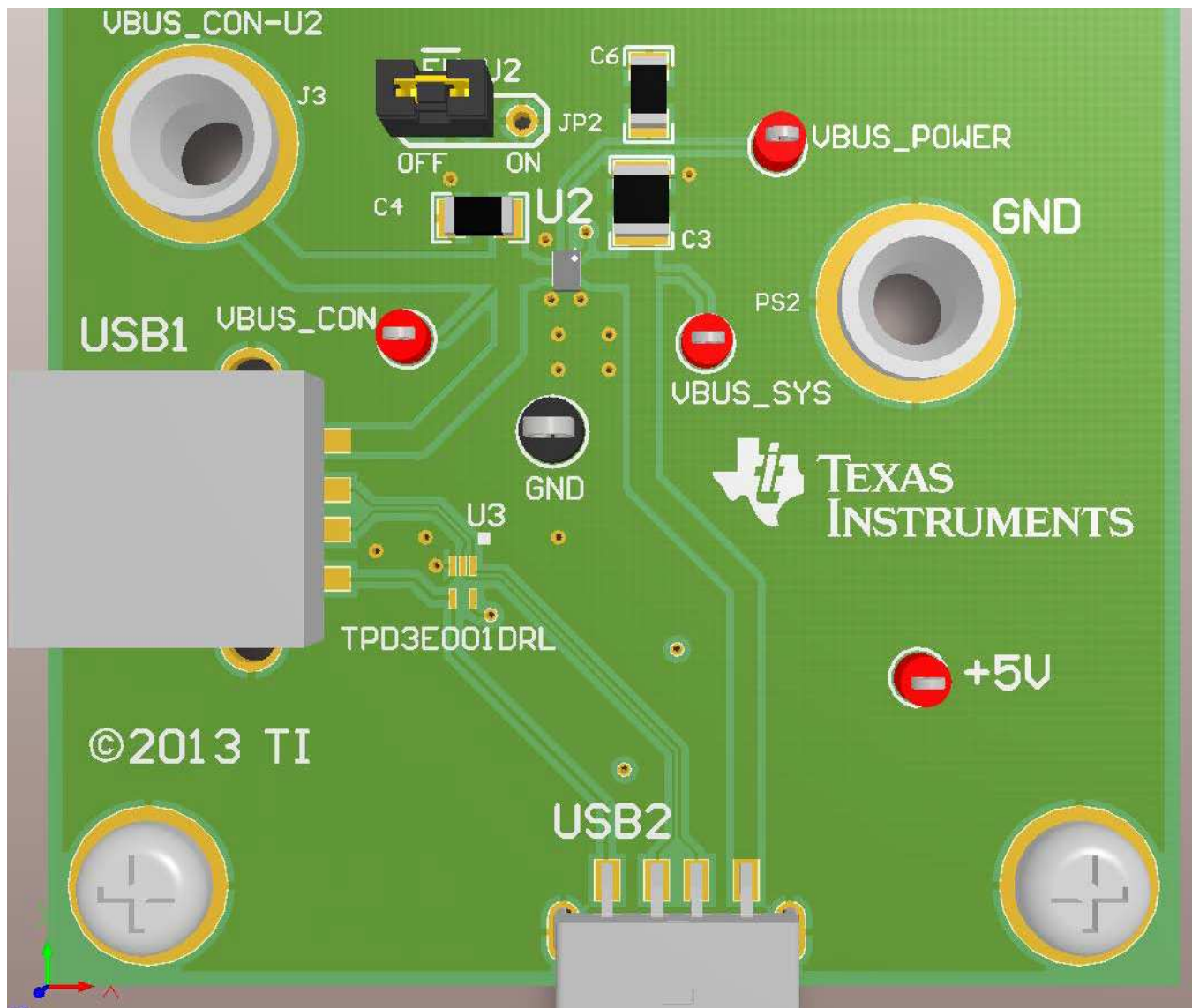
2.2 U2


Figure 2. TPD1S514 Board Configuration for U2

A pass through USB2.0 port is included for system level testing. The female USB connector (USB1) is the “Connector” side of TPD1S514-2 and a male USB connector (USB2) is the “System” side. ESD protection has been added to the Hi-Speed data lines and ID pin in the form of TPD3E001DRL to complete the port protection example scheme.

Surge can be injected into V_{BUS_CON} using J3.

A 3-pin header (JP2) allows shunting the \overline{EN} pin on or off. Test points allow monitoring of V_{BUS_CON} , V_{BUS_SYS} , and V_{BUS_POWER} .

3 Schematics

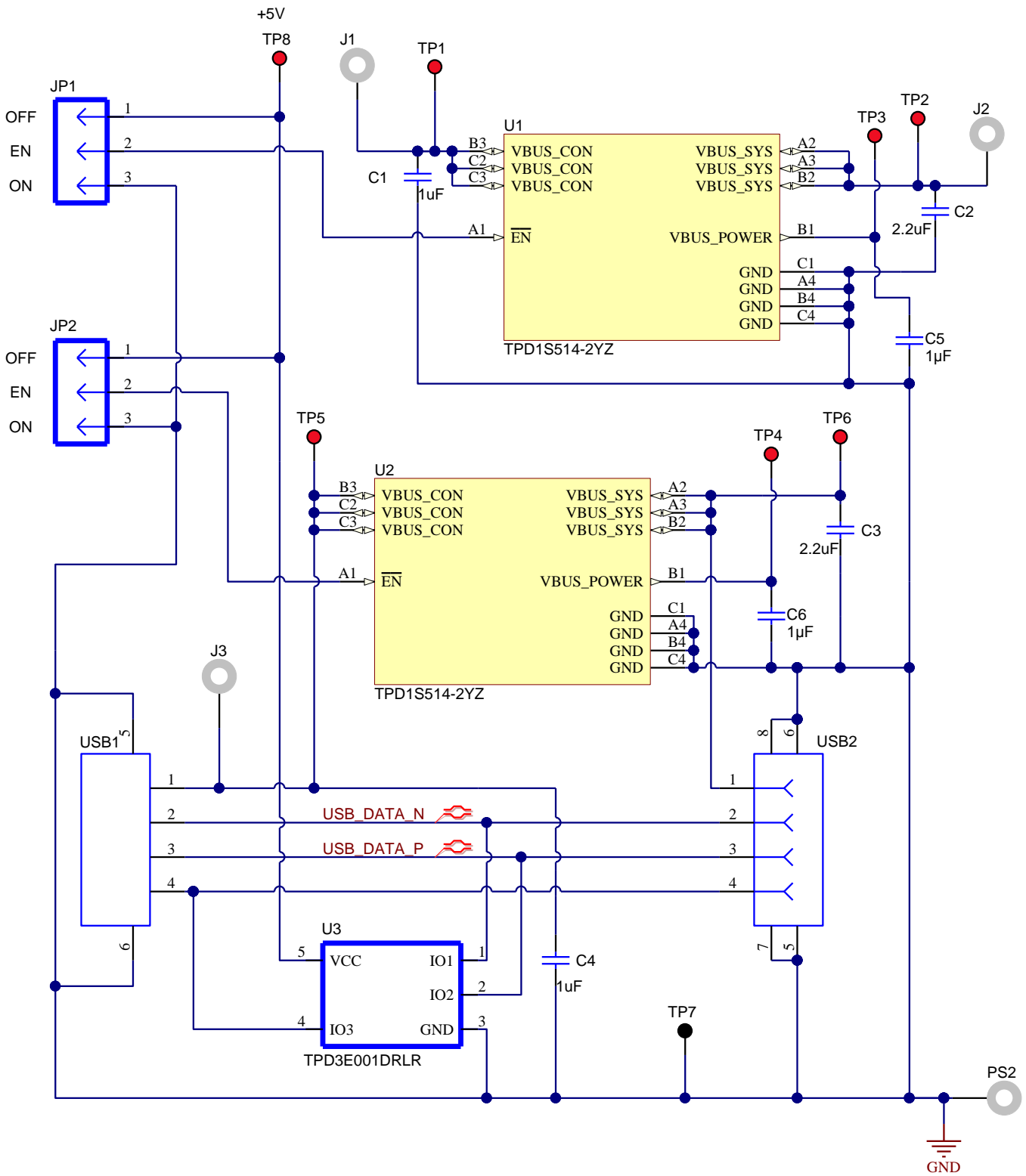


Figure 3. TPD1S514-2EVM Schematic

4 Board Layout

This section provides the TPD1S514-2EVM board layout. TPD1S514-2EVM is a 4-layer board of FR-4 at 0.062" thickness, with ½ oz. copper outer layers and 1 oz. copper inner layers.

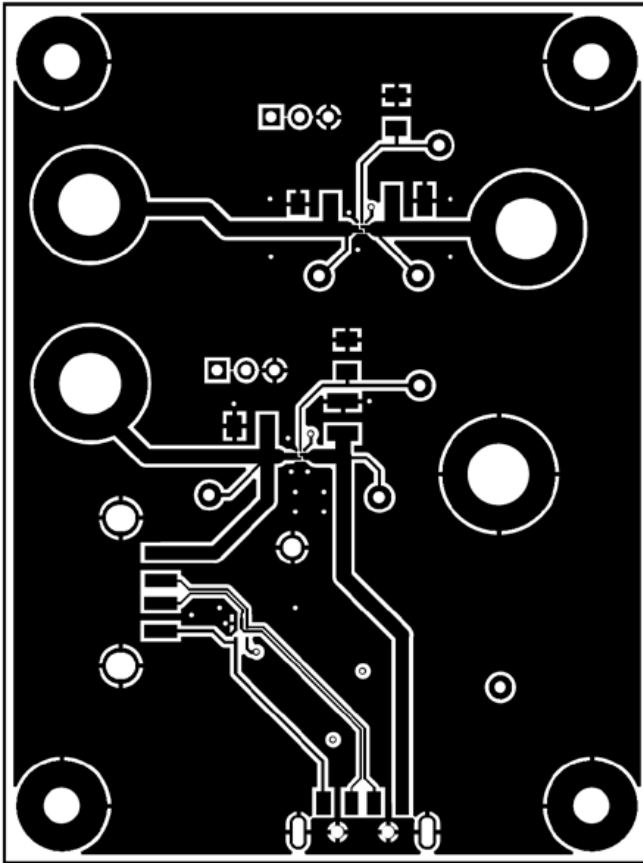


Figure 4. Top Layer Copper

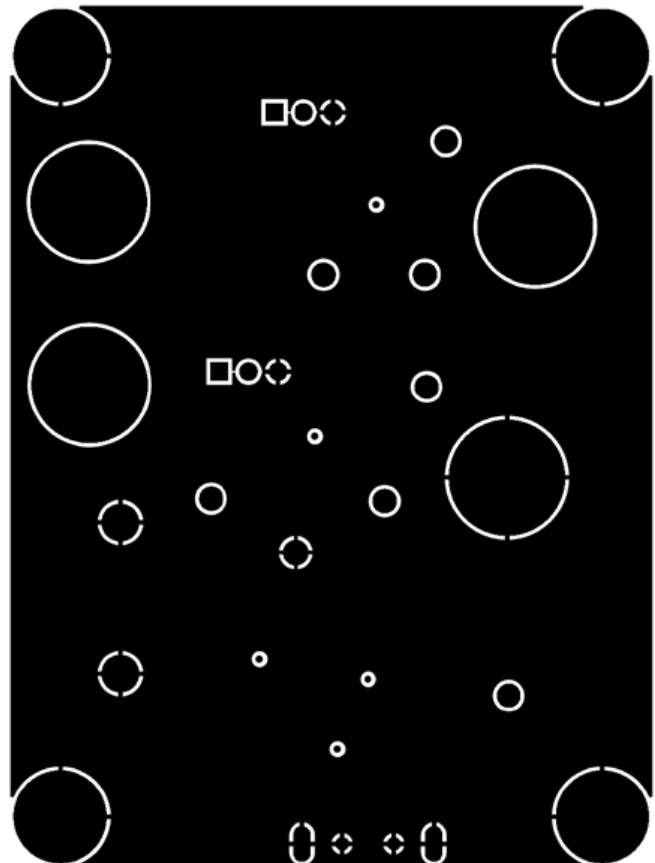


Figure 5. Second Layer Copper

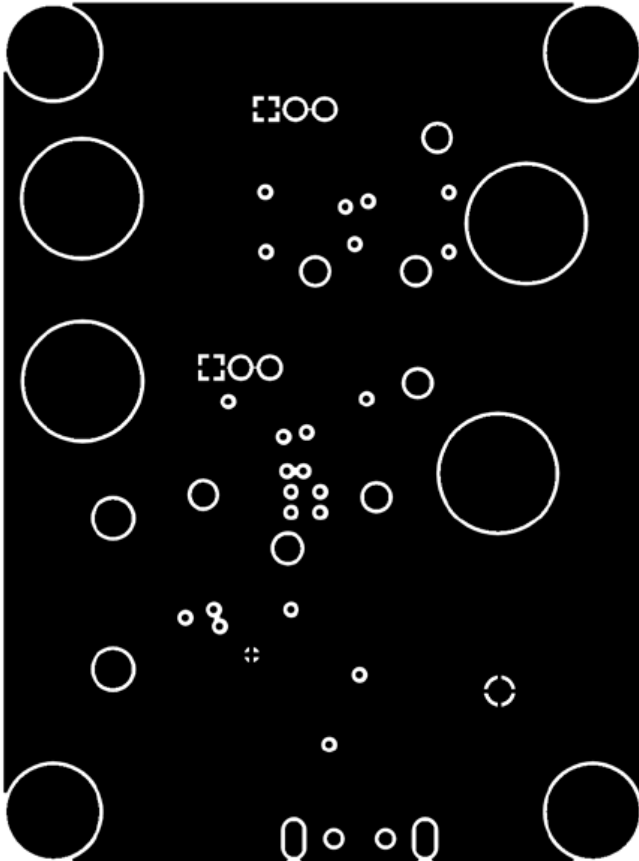


Figure 6. Layer 3 Copper

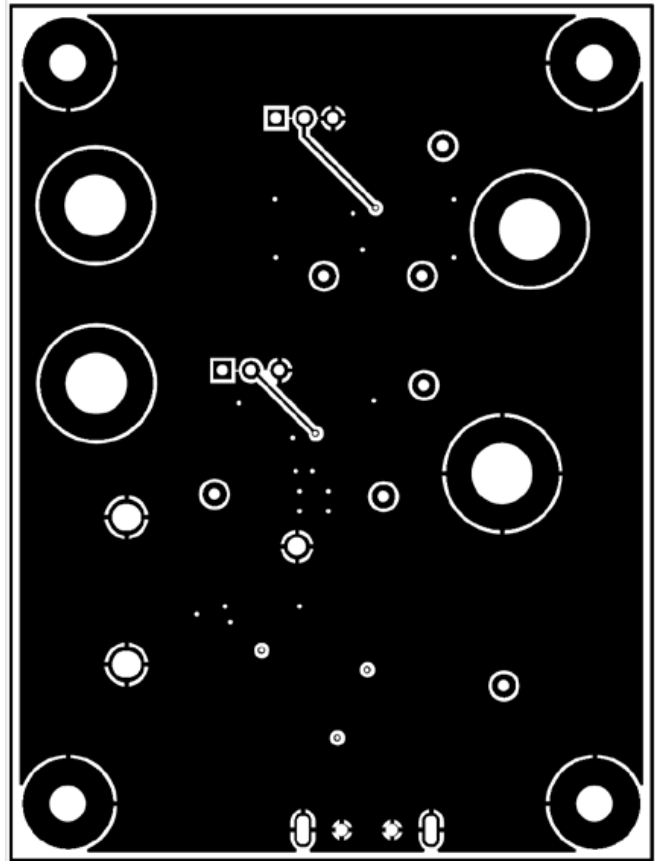


Figure 7. Bottom Layer Copper

5 Bill of Materials

Table 2. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C1, C4, C5, C6	4	1 μ F	CAP, CERM, 1 μ F, 25V, \pm 10%, X7R, 1206	1206	12063C105KAT2A	AVX
C2, C3	2	2.2 μ F	CAP, CERM, 2.2 μ F, 100V, \pm 10%, X7R, 1210	1210	GRM32ER72A225KA35L	MuRata
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2, J3, PS2	4		Standard Banana Jack, Uninsulated, 5.5mm	Keystone_575-4	575-4	Keystone
JP1, JP2	2	PEC03SAAN	Header, Male 3-pin, 100mil spacing,	0.100 inch x 3	PEC03SAAN	Sullins
SH-J1A, SH-J2A	2	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP6, TP8	7	Red	Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone
TP7	1	Black	Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone
U1, U2	2		USB Charger Over Voltage, Surge and ESD Protection for VBUS_CON Pin, YZ0012AFV	YZ0012AFV	TPD1S514-2YZ	Texas Instruments
U3	1	TPD3E001DRLR	IC, LOW-CAPACITANCE 3-CHANNEL \pm 15-kV ESD-PROTECTION ARRAY FOR HIGH-SPEED DATA INTERFACES	SOP-5 (DRL)	TPD3E001DRL	Texas Instruments
USB1	1		Connector, Receptacle, USB TYPE A, 4POS SMD	USB TYPE A CONNECTOR RECEPTACLE 4POS SMD	896-43-004-00-000000	Mill-Max
USB2	1		Connector, USB Type A, 4POS R/A, SMD	USB Type A right angle	48037-1000	Molex

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com